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STREPTOTHRICHA

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PLATE XLI.

The researches of the past quarter of a century have brought to light many species of micro-organisms whose relations to certain pathological processes have been shown to be of the nature of cause and effect. Among these are included representatives from various groups, bacteria, protozoa, yeasts and moulds. The greatest success thus far achieved has been in the study of the bacteria; indeed, until recently these were regarded as almost the only vegetable micro-organisms capable of causing infectious pathological processes. Our knowledge of the biology of the pathogenic vegetable micro-organisms has more recently been extended in two directions. In the first, certain of the blastomycetes have been proven to be pathogenic for man and animals; in the second, the morphology of the bacteria has been found to depart from the simple formula originally assigned to them. In view of these facts it has been considered necessary to designate a new class for the reception of those vegetable micro-organisms which, while exhibiting affinities with the bacteria, at the same time possess certain features in common with the hyphomycetes. To this class Kruse has given the name *Streptothrices*. Its limits are ill-defined, chiefly for the reason that occasionally one of the common bacterial forms (*B. tuberculosis*, *B. diphtheriae*, *B. proteus*) will show certain of the characteristics of the group, while for the most part they appear as simple rods.

The streptothrices resemble the moulds in that they develop from spores into cylindrical, dichotomously-branching threads, which alternately grow into colonies the appearances of which suggest a mass of radiating filaments (mycelia). Certain of the threads become fruit-hyphæ, and these break up into chains of round spore-like bodies.

With the bacteria they agree in so far as they lack a doubly-contoured membrane, in not being composed of hyphae filled with fluid and granular contents and separated from each other by partition walls, and from the fact that they appear as homogeneous threads, resembling the filiform bacteria, which, finally, in older cultures, separate into short bacillary and coccus-like structures (Kruse).*

The researches of Boström † prepared the way for the later studies upon the micro-organism causing actinomycosis and led finally to its classification with the streptothrices under the name of streptothrix actinomyces (Rossi-Doria). Another pathogenic species is represented by streptothrix maduræ (Vincent). These two are the best known pathogenic forms; and an extensive study of their characteristics shows that it is not improbable that they may represent genera rather than species, so that ultimately it may become necessary to distinguish different species or, perhaps, only varieties of each.

The remaining streptothrices described in connection with pathological processes in man are much less well defined. All the pathogenic possibilities of the class have not as yet been discovered. Rosenbach ‡ found a branching micro-organism, capable of growing upon artificial media and of reproducing upon inoculation a similar pathological condition, in an affection known as *erysipeloid* (*Erythema exsudativum multiforme*). Eppinger § isolated from a brain abscess, which had ruptured into the lateral ventricle and set up meningitis cerebro-spinalis, a branching micro-organism which he regarded as a cladothrix (*C. asteroides*), but which by Kruse is classed with the streptothrices (*S. eppingerii*). Eppinger injected cultures into guinea-pigs and rabbits and observed that it caused a typical pseudo-tuberculosis. Indeed, the cerebral abscess suggested the disintegration of a large tuberculous focus. The case reported by Garten || is not so clear.

* Kruse, In Flügge's *Die Mikroorganismen*, 1896, ii, 48.

† Boström, *Untersuchungen über die Actinomykose des Menschen*, Ziegler's *Beiträge*, ix, 1890.

‡ Rosenbach, *Ueber das Erysipeloid*, *Archiv f. klin. Chirurgie*, xxxvi, 346.

§ Eppinger, *Ueber eine neue, pathogene Cladothrix und eine durch sie hervorgerufene Pseudotuberculosis (cladothrichica)*, Ziegler's *Beiträge*, ix, 287.

|| Garten, *Ueber einen beim Menschen chron. Entzündung erregenden, pleiomorphen Mikroben*. *Zeitschr. f. Chirurgie*, xli, 257.

This author obtained in pure culture a branching micro-organism from abscesses and a fistulous tract, extending from the upper dorsal vertebrae to the sacrum, the ribs and vertebrae showing erosions. While he regards the organism as a new species, its distinction from streptothrix actinomyces is by no means clearly established.

Additional instances of streptothrix infection are reported by Sabrazès and Rivière,* and by Ferré and Faguet.† The first case of Sabrazès and Rivière occurred in a man in whom abscesses were found in the brain, lungs and kidney (softened infarction). The pus from the brain abscess showed single and radiating, branching threads; in the kidney the filaments were much shorter, while in the lungs neither form was discovered. In cultures cocci were found associated with the streptothrix, the latter growing anaerobically only. In a second case these observers isolated from sputa and from a subcutaneous abscess in a man an aerobic streptothrix, pathogenic for small animals. Ferré and Faguet obtained in pure culture from an abscess of the brain in an epileptic, a streptothrix which proved, however, to be non-pathogenic for guinea-pigs and rabbits.

It is now well known that under certain unusual conditions the bacillus tuberculosis is capable of appearing in an irregular branched form.‡ Further observations are, however, necessary before accepting as final the results obtained by Friedrich § and Babes and Levaditi,|| who inoculated cultures of the bacillus tuberculosis into the carotid artery and beneath the dura mater, respectively, in rabbits, and found that the bacilli had not only branched but had also developed into rosettes resembling the "Drusen" of actinomyces.

Another streptothrix pathogenic for man is one upon which a pre-

* Sabrazès et Rivière, Sur un streptothrix rencontré dans un cas d'abcès du cerveau et d'infarctus suppuré du rein. *La presse médicale*, 1894, Sept. 22.

† Ferré et Faguet, Streptothrix et abcès du cerveau, *Mercredi médical*, 1895, 441.

‡ For the literature on this subject see Craig. The branched form of the Bacillus tuberculosis in sputum. *Journal of Experimental Medicine*, iii (1898), 363.

§ Friedrich, Ueber strahlenpilzähnliche Wuchsformen des Tuberkelbacillus im Thierkörper, *Deutsche med. Wchnschr.*, xxiii, 1897, 653.

|| Babes et Levaditi, Sur la forme actinomycosique du bacille de la tuberculose, *Arch. de méd. exper.*, 1897, 1041.

liminary note appeared in the Johns Hopkins Hospital Bulletin * for June, 1897, and of which the present paper will contain a more complete account.

A consideration of the morphology of the peculiar micro-organism, which was associated with consolidation, necrosis and early cavity formation in the lungs of a human being, and the nature of the pathological process, which in so many ways suggested the caseous pneumonia of true tuberculosis, led to the adoption of the name *Streptothrix pseudo-tuberculosis* for the organism, and *pseudo-tuberculosis hominis streptothricha* as a designation for the pathological condition.

The clinical history of the case offered nothing of especial importance. The patient was a male, colored, aged 70 years, in whom extensive consolidation was made out in both lungs. The symptoms were broadly those characteristic of pulmonary tuberculosis. Sputum was carefully watched for during his stay in the hospital, in Dr. Osler's service, but none was obtained. No microscopical examination could therefore be made.

The autopsy was made 19 hours after death, the body in the meantime having been kept on ice. No evidences of post-mortem decomposition were noticeable. The description of the viscera is limited here to the organs which exhibited pathological alterations.

The *lungs* are voluminous and meet in the middle line anteriorly. They are not bound to the chest wall. *Left.* All of the upper lobe, except the anterior edge, is consolidated more or less perfectly. Where the consolidation is complete, as in the apical portion, the lung presents an opaque appearance, and is grey in color; beginning softening (disintegration with early cavity formation) is going on. These cavities often still contain the products of disintegration, and all appearances of reactive encapsulation are wanting. The lower zone of this lobe is more flaccid and contains scattered areas of consolidation between which the lung tissue is oedematous and swollen, although not completely airless. The lower lobe is congested and oedematous; it contains a number of scattered and partly calcified nodules which on an average are the size of a split pea. The pleura over the hepatized area is covered with a fibrinous exudate. *Right.* The middle lobe is almost completely consolidated. The other lobes contain several small calcified nodules

* Flexner, Pseudotuberculosis Hominis Streptothricha, a preliminary note. *Johns Hopkins Hospital Bulletin*, vii, 1897, 128.

and a number of recent, tolerably circumscribed, caseous areas, averaging in size that of a walnut and surrounded by edematous, imperfectly consolidated and dark lung substance. The lower lobe contains an almost globular, infiltrated area, 4.5 cm. in diameter, caseous in appearance, the centre of which is undergoing disintegration. The pleura over the fresh foci of consolidation is covered with fibrin and studded with small haemorrhages.

Peritoneal Cavity. The intestines are moderately distended. The omentum is rolled up and thickened; it occupies a position beneath the transverse colon and extends across the abdominal cavity. The pelvis contains about 15 cc. of fluid of a brownish color and mucilaginous consistency. Between the intestinal loops delicate threads of fibrin exist. In addition smaller and larger nodules, resembling tubercles, usually translucent, are scattered irregularly over all the exposed peritoneal surfaces, and occur more uniformly upon and within the thickened, rolled-up omentum. The liver and spleen on section show similar nodules. The mesenteric glands are not perceptibly enlarged, but upon section minute, opaque tubercles are visible in them.

Histological Examination. The microscopical study of the tissues of the case embraced all the organs. Reference will be made here only to the lungs, the peritoneum and the omentum, in which organs the chief lesions existed.

The pathological process in the lungs consists chiefly of an exudation, which is not, however, of uniform character. For the most part the exudate is cellular, but in certain situations it is composed largely of fibrin.

A stained section of the lung macroscopically presents a variegated appearance due to this heterogeneous exudate. Where this is cellular, a deep nuclear staining is evident; elsewhere the tissue appears pale. The cellular exudate is intra- and inter-alveolar; it is rare, indeed, that the alveolar walls are free from infiltration. The cells composing it are chiefly polymorphonuclear leucocytes, but what is most striking is the extent of fragmentation which these cells have suffered. A small amount of fibrin exists among the cells. Many alveoli contain fibrin almost to the exclusion of leucocytes; this fibrin is dense and compact and encloses cells of the epithelioid type. In certain situations, especially near the somewhat thickened pleura, the

fibrin in the alveoli is undergoing rapid organization. The pleura is covered by a fibrinous membrane 3 or 4 times the normal thickness, capped by a thin line of dense fibrin in process of organization.

There is a marked tendency for the tissue showing the cellular infiltration to break down, with formation of cavities showing softened contents. It is found that this softening has taken place only where the infiltration of the alveolar walls has reached a high degree. But the gross examination of the lungs gave no adequate idea of the extent of this process of disintegration, many of the foci being microscopical in size. The disintegrating tissue differs from the general cellular infiltration only in containing more nuclear fragments and irregularly staining detritus. In specimens stained with haematoxylin and eosin this irregular material takes on a peculiar, imperfect haematoxylin tint, resembling that shown by certain kinds of caseation in tuberculous forms of pneumonia. In the regions in which the exudate is purely or largely fibrinous no such tendency to softening and disintegration is manifest. There is no attempt at limitation or encapsulation of the areas of cavity formation by a growth of demarcating connective tissue.

Circumscribed nodules having the size, form and appearance of miliary tubercles occur in small numbers. They are composed chiefly of epithelioid cells, some of which are disintegrating. Giant cells are not seen.

The bands of interlobular tissue are thickened by a new growth of tissue, and islands of fibroid tissue appear here and there in the lung substance. The blood-vessels are extensively obliterated. This obliteration is caused either by an endarteritis or by thrombosis; sometimes both processes are met with in the same vessel.

Of the structures contained within the abdominal cavity, the intestine and omentum more especially were subjected to histological study. Of these the latter gave the more interesting results. The thickening of the omentum is caused chiefly by a growth of tubercle-like nodules, which cover its surface and also occupy its interior. The nodules are, on an average, larger than miliary tubercles, and still larger masses are formed by the coalescence of several such foci.

In general two kinds of nodules are distinguishable. The larger, probably the more numerous, exceed in size a military tubercle; they are composed of a central mass of disintegrated or disintegrating cells and nuclei. Very irregular nuclear forms are met with, some of these doubtless being emigrated polymorphonuclear leucocytes. Nuclear figures occur now and then among the degenerating cells, but these are taken to be examples of karyorrhexis and not as representing true cell division. Definite fragments of nuclei are common. The centre of such a nodule is occupied often by a transverse section of a small vessel in which white blood-cells can be seen now and then; the lumen is lined by endothelial cells, usually in increased numbers. Beginning at the thin outer wall and often taking in everything except the endothelial cells, a homogeneous material may be noticed, which extends for a variable distance into the tubercles proper, obliterating cell-boundaries as it spreads. With Weigert's fibrin stain this substance takes on a distinctly blue color. The more peripheral parts of the nodules contain more unaltered cells, these presenting the usual appearance of epithelioid cells, although more elongated types (fibroblasts) and irregular leucocytes are also met with. The most external cells are lymphoid, and these, together with more or less polymorphonuclear leucocytes, go over into the surrounding adipose tissue and coalesce with other nodules. Giant cells appear rarely in the less degenerated parts.

In the sections stained with haematoxylin and eosin a delicate fibrillated network can be made out among the cells and fragments, which, in specimens stained especially for it, is found to consist of fibrin.

The smaller nodules differ from these in that they are made up of cells which are well preserved and possess large nuclei of the epithelioid type. The cell protoplasm is relatively abundant, and a suggestion of fibrillation is visible in the substance between the cells. This kind of nodule is found in the peritoneal covering of the intestines, where they form an almost uniform layer. Almost no degenerated cells are met with in these formations.

Giant cells are present within the nodules, but they are not abund-

ant there, and they occur without these in the more diffusely infiltrated tissues. Their forms correspond with those found in ordinary tubercle, showing as a rule the peripheral disposition of nuclei and the central hyaline protoplasm. But multinucleated giant cells either with peripheral or centrally massed nuclei occur with especial frequency within the lumina of small blood and perhaps lymph-vessels. It sometimes happens that such a cell occupies the central vessel in one of the first nodules described; but it is more common for them to appear in somewhat larger vessels outside or just at the periphery of the nodules. They are derived from the endothelial lining of the vessels which is met with in the several stages of proliferative activity leading to their formation.

The bacteriological examination. The examination for bacteria consisted in the study of cover-slips from the fresh lungs, the inoculation of glycerine-agar tubes, and the subcutaneous injection into a guinea-pig of a suspension from the consolidated lungs. After hardening the tissues, sections from the lungs, from the peritoneal covering of the intestines and from the omentum were stained for bacteria. Cover-slips from the lungs stained by Gabbett's method showed no micro-organisms which resembled the bacillus tuberculosis in their morphology, but there remained faintly stained in carbol-fuchsin upon the cover-slips numerous examples of a branching organism occurring often in clumps or convoluted masses, among which no ordinary bacillary forms were discovered. Through the use of Weigert's method of staining bacteria the micro-organism was rendered suitable for more exact study.

The cultures from the left pleural cavity and the peritoneum remained sterile. Three separate sets were made from the lungs. In all these, at the end of 24 hours, a vigorous growth of a bacillus identified as belonging to the group of *B. coli communis* had taken place. The streptothrix did not grow.

The guinea-pig showed no reaction to speak of at the site of inoculation, the adjacent lymph glands could not at any time be felt; the animal, however, lost in weight and died at the end of the 9th week, at the autopsy showing great emaciation. None of the lymphatic

glands were found enlarged; there were no lesions resembling tubercles in these and other organs, and cultures upon glycerine-agar, made from several sources, remained sterile. Cover-slips from the serous cavities, blood and viscera were negative for any kind of bacteria.

The further study of the organism stained upon cover-slips prepared from the lungs at the time of the autopsy, by Weigert's method, in which carbol-fuchsin is substituted for gentian-violet, shows it to possess the following characteristics: The micro-organism appears only in streptothrix forms, rarely as single branching filaments, but usually as masses, more or less convoluted, in which the several individuals seem at times to participate. This tendency to form convoluted masses renders the length of the filaments variable; some, however, stretch across the field of the microscope (1/12 objective). The thickness varies also, but to a less degree and in general is about the same as that of *B. proteus*. The branches are often short and rarely capped at the extremity with a conical swelling (conidia?). That these bodies are not actual conidia is, I think, further proved by their occurrence in the course of the filaments. They doubtless belong to the chromatic particles to be described later. There is protoplasmic continuity between the parent filament and the branch. The contours are slightly irregular, the staining sometimes not quite uniform, and very rarely just before its termination a filament will show 2 or 3 cross partitions suggesting the breaking up into as many short rods. Coccus-like forms were not encountered.

An irregularity in staining is one of the common features of the organism, an appearance, moreover, that depends in part upon the extent of the decolorizing process. The more deeply-stained filaments are a little thicker than those which stain faintly, and the chromatic granules or particles which lie close together in the former may be separated in the latter by widths of unstained protoplasm of greater diameter than the stained particles. In the most pronounced cases the chromatic bodies appear to lie within a non-staining homogeneous membrane (Plate XLI, Fig. 1). The possibility that this difference may depend upon other causes, *e. g.* degeneration, cannot be excluded, but the impression obtained is that it is more or less artificial, and has something to do with the degree of staining, etc.

Sections from several different parts of the lungs were stained first in haematoxylin and then in carbol-fuchsin, which was followed by pure aniline oil, for the purpose of differentiation and dehydration. The nuclei appear blue; the micro-organisms red. The latter are very abundant. Their relation to the pathological process is very intimate and somewhat as follows: The only parts of the lung tissue from which the micro-organisms appear to be absent are the areas occupied by the fibrinous exudate. The cellular exudate everywhere shows them, but the streptothrix is most abundant, appearing in the largest masses in the areas of rapid disintegration (Plate XLI, Figs. 2 and 3). The masses of the organism are somewhat larger than are met with in the cover-slips and the branching is more perfect, perhaps because the normal relations are less disturbed in the sections. Rarely, a small fragment of a filament or a separate thread will be present in a mass of pus cells and fragments of cells. The streptothrix appears, but in relatively small clumps; within the tubercle-like nodules; more often indeed a single branching filament is met with in these formations.

The staining of the threads is somewhat more irregular than in the cover-slip preparations; they present a granular, almost beaded appearance, and are thinner than under the former conditions (Plate XLI, Fig. 3).

The omentum especially, of the abdominal organs, was studied for micro-organisms. A large number of sections were treated first with carbol-fuchsin in the thermostat and then carefully decolorized with 1 per cent hydrochloric-acid alcohol. Bacteria were never found in these specimens. Other sections were then stained by the method used for demonstrating the streptothrix in the lungs. Almost every specimen prepared in this way showed bacteria, and often in very considerable numbers. They were contained within the tubercle-like nodules.

The forms of micro-organisms met with in this situation are simpler than those in the lungs. So far as could be discovered from many sections, the individual organisms never branch. They appear as rods of unequal lengths and of a curved or angular form. The staining is irregular, a beaded appearance being very common. The "bead-

ing" is quite irregular; more so, I am disposed to think, than is the case with *B. tuberculosis*. In examples showing the most pronounced irregularity, the organism appears as a nearly colorless filament with uneven deeply-staining red dots placed at different intervals from one another. In length as well as in width the rods rather exceed the average dimensions of the tubercle bacillus. It must, however, be admitted that not a few individuals could not be distinguished by their size alone from this micro-organism.

From the foregoing description there can be, I think, no reasonable doubt that the micro-organism encountered in the lungs differs widely from the known forms of *B. tuberculosis*. This fact is also supported by the negative animal experiment described. On the other hand, it is equally clear that the pathological process set up by it in the lungs bears no little resemblance to one set of changes at least met with in the same organs in tuberculous pneumonias. We notice in both cases the same tendency to infiltration of the framework of the lungs, degeneration of the inflammatory exudate, and to necrosis and solution of the tissues and exudate. In the particular case under consideration one point of difference is to be seen in the dearth of proliferated and desquamated alveolar epithelial cells within the exudate. But this difference is insufficient to characterize the two processes as essentially distinct. On the other hand, the impression is obtained that the solution of the exudate and framework of the lungs is going on more rapidly, from a greater number of centres, than is the case in ordinary cases of caseous pneumonia.

The analogy of the two processes is strengthened by the finding of tubercle-like nodules in the lungs amid the diffuse exudate. These were, it is true, few in number; but in structure they could not be distinguished from veritable tubercles, and they were proven to have been caused by the streptothrix under consideration, by the demonstration of the organism within them. It will be recalled that sections of the lungs stained for tubercle bacilli by the ordinary method failed to reveal the presence of this micro-organism.

When we come to consider the significance of the tubercles in the peritoneal cavity, it must be admitted that the case in favor of their

streptothrix origin is less clear and convincing. But I am inclined to the belief that they owe their presence to the same parasite, which, however, owing to differences in the location and function of the parts, appears under somewhat different morphological forms. In view of the great numbers of micro-organisms contained within these nodules, it seems justifiable to conclude that they would have been demonstrated by the usual stains for tubercle-bacilli; had they been of this nature. But I am unwilling to draw very wide-reaching deductions from this fact alone. The differences in morphology of the organism, when compared with the tubercle bacillus, may again be remembered, without, however, laying too much stress on small distinctions. Perhaps the most convincing argument is to be found in the existence of similar nodules in the lungs, whose etiology seems established. In these formations the organism appears under a simpler morphology than when growing freely within the lung substance.

It would not be profitable, nor would it conduce much to a clearer understanding of the variation in morphology, to dwell upon the influence of environment upon the growth and morphological character of the bacteria; but it should be borne in mind that our knowledge of such variation is constantly increasing and even now includes some of the commoner and more ordinary bacterial forms.

If in the comparison of the lesions in the lungs with those of caseous pneumonia, sufficient proof has been brought of their great similarity to these, more conclusive evidence is at hand of the essential identity of the nodules in the peritoneal cavity with the tubercles caused by the bacillus tuberculosis. It is believed that upon histological grounds alone no distinction could be made.

From these considerations there can be little doubt that the streptothrix described is the cause of the pathological process met with in the lungs and peritoneal cavity, and that in the latter the pathological picture of the disease resembles so nearly tuberculosis in human beings that the two diseases can be separated only by the demonstration of the causative micro-organism in each case. It is, of course, not without the pale of probabilities that at some future time a clinical picture differing from that of true tuberculosis may come to be established for this disease.

If this conception of the pathological changes produced by the streptothrix under consideration be true, the process must be admitted to be a form of pseudo-tuberculosis in man for which the name at the head of this paper is proposed.

The question now arises whether a similar pathogenic streptothrix, producing analogous lesions, has thus far been described. There seems little doubt from the descriptions given of the pathogenic species of this organism in the introductory pages of this paper, that the forms there mentioned differ from the one under consideration. At least no good grounds are at hand for concluding that in any case they are identical or even closely related. Not so, however, with the streptothrix described by Buchholz,* whose publication appeared simultaneously with the preliminary communication concerning the streptothrix pseudo-tuberculosis. It may perhaps be profitable to consider Buchholz's findings more in detail.

The patient was a steel worker, 38 years old, who became suddenly ill 5 weeks before admission to the Institute for Infectious Diseases in Berlin. He entered on November 19, at which time there was absolute dulness over the entire right side of the thorax, with rales and bronchial breathing. The sputum showed numerous streptococci but no tubercle bacilli. The fluid obtained by puncture from the pleural cavity contained streptococci. On November 22, 300 cc. of pus evacuated from the pleural cavity again showed streptococci. Death occurred on December 12th. The autopsy showed the right lung to be united throughout with the costal pleura; the left lung was bound to the diaphragm. The portion of lung corresponding with the adhesion to the diaphragm showed a consolidated focus the size of a hen's egg, which on section appeared to be necrotic. In the pleura covering the right lung were two formations which led directly into two large cavities, themselves communicating, filled with purulent contents and exhibiting ragged and uneven walls. The pus had a fetid odor; the remainder of the right lung, excepting the apex, was firmly consolidated. The rest of the organs showed no abnormality. The anatomical picture suggested an advanced tuberculosis, except that the edges of the cavities were more ragged. Tubercle bacilli could not be demonstrated; streptococci were, however, contained in the pus.

* Buchholz, Ueber menschenpathogene Streptothrix. Ein Beitrag zur Aetiologie des acuten Lungenerfalls. *Zeitschr. f. Hygiene u. Infectionskrank.*, xxiv, 1897, 470.

The microscopical examination of sections was negative for tubercle bacilli; the histological picture, too, was regarded as showing differences from that of tuberculosis. The infiltrated parts of the lung presented more the appearance of an acute pneumonic exudate; but in places the interstitial infiltration was so marked as to obscure the structure and the cells were undergoing necrosis (fragmentation, etc.). Stained by Gram's method the firm, infiltrated and necrotic areas showed a rich network of delicately branching threads of about the thickness of tubercle bacilli, which never appeared in the form of long bacilli, but suggested "lines sketched by the trembling hand or the gnarled branches of the oak." Coccus-like and short bacillary forms were not found. The streptococci were contained in the portions of the lung which were consolidated, the alveolar walls being thickened and the alveoli in part atelectic. They were also present in the secretion of inflamed bronchi and in the interstitial lymph-spaces, from which situations the streptothrix was absent. The streptococci are regarded as having been secondary invaders. Cultures were not obtained from the lungs, the plates being overgrown with a variety of proteus. Animal experiments seem not to have been carried out. It is interesting to note that the same difficulty in staining the micro-organism was experienced as recorded in my case, and the most satisfactory preparations were obtained by the use of Gram's method, in which aniline-oil replaces the alcohol.

The resemblance of this case to the one described by me is very striking, but there are also points of marked difference. As regards the latter, the absence of all nodular formations suggesting tubercles and the extensive cavity formation in the right lung stand out in great contrast. On the other hand, it is conceivable that the cavities in Buchholz's case merely represent a later and more advanced stage of the condition present in mine. The description of the micro-organism is strikingly like that given for the streptothrix pseudo-tuberculosis, and in further support of their probable identity, I may mention that Dr. Rabinowitsch, who kindly carried slides of my case to Berlin with her, reports that Dr. Buchholz, after examining the preparations and comparing them with his own, regards them as probably identical.

At the last meeting of the Congress for Internal Medicine, held in Wiesbaden, Scheele and Petruschky* exhibited cultures and micro-

* Scheele and Petruschky, *Culturen u. Präparate einer menschen-pathogenen Streptothrix-Art.* Verhand. des XV. Cong. f. innere Medicin, 1897, 550.

scopical preparations of a pathogenic streptothrix obtained from a woman, aged 56 years, whose history, in brief, is as follows:

The patient gave a family history of tuberculosis, but had herself always been well. In November of the previous year she nursed a sister who died of tuberculosis. In February she suffered with what was supposed to be influenza; in March a cystitis developed, and about the middle of April several small tumors appeared in the skin about the joints (hip, sterno-clavicular), and later in the thigh, gluteal region, etc. The tumors suppurred. In the beginning of May the left upper lobe of the lung showed a fairly intense infiltration. The sputum was examined, but no tubercle bacilli could be found; on the other hand, masses of a "fungus" suggestive of penicillium were made out and a similar organism was demonstrated in the pus from the tumors. The patient died on June 6th. The protocol is not given in this preliminary report. The micro-organism is, however, described as having been obtained in pure culture from the pus from the tumors; in the lung it was admixed with the bacillus influenzae. In both situations it was abundant. The parasite is said to consist of fine, branching threads without showing any evidences of fructification. The complete description is reserved for a later publication.

In this instance it would be merely a matter of conjecture to consider that the lesions in the lungs and the streptothrix are similar or identical with those described by me; indeed, the clinical course of the case is not especially suggestive of similarity. The important consideration for the present is not to attempt a classification of the several pathogenic streptothrix forms now known, but to recognize their importance in human pathology, and more especially that the lesions, which they produce in the lungs, may be suggestive of certain forms of pulmonary tuberculosis both in their clinical course and their anatomical appearance. Moreover, as the parasite is doubtless thrown off with the expectoration, it should be sought in doubtful cases in the sputa; and for this purpose the usual methods of staining for tubercle bacilli are not suitable. I should recommend the use of the modification of the Gram-Weigert stain with which the parasite was demonstrated in smear-preparations and in sections.

I wish to thank Dr. W. M. Gray for the photomicrographs which accompany this paper.

DESCRIPTION OF PLATE XLI.

Fig. 1. Photomicrograph of smear-preparation from lung.

Fig. 2. Photomicrograph from section of the lung. Both show the streptothrix: Fig. 1, free; Fig. 2, in intimate association with the exudation. Photographs by Dr. Gray, of Washington.

Fig. 3. Section of lung stained in hæmatoxylin and carbol-fuchsin. Zeiss 1/12 in homog. immersion objective. The characteristic beading of the streptothrix is well shown.

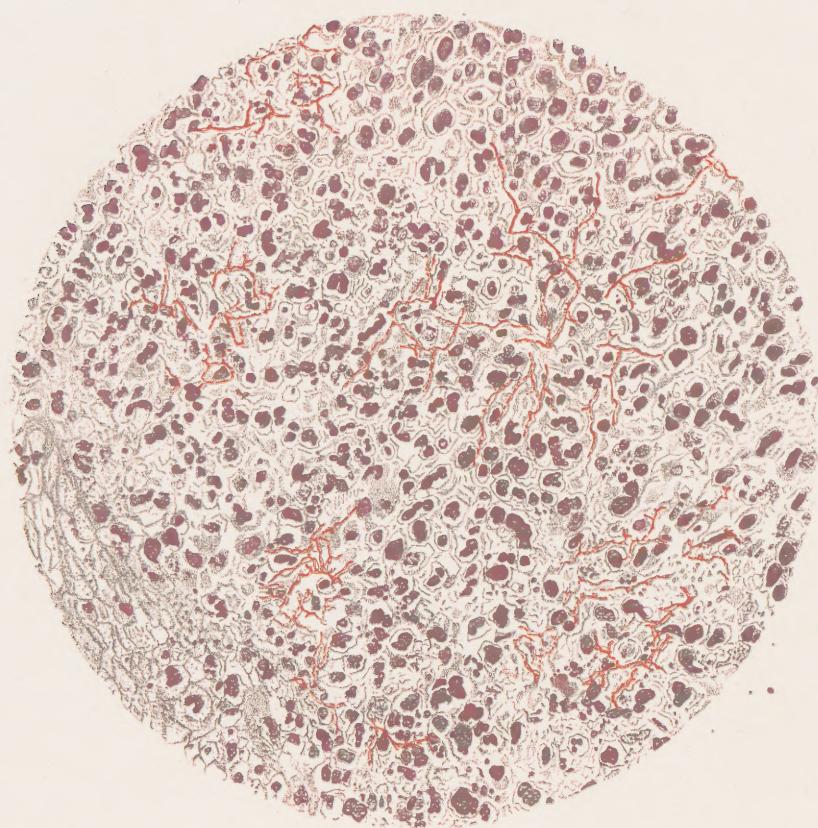


FIG. 3.

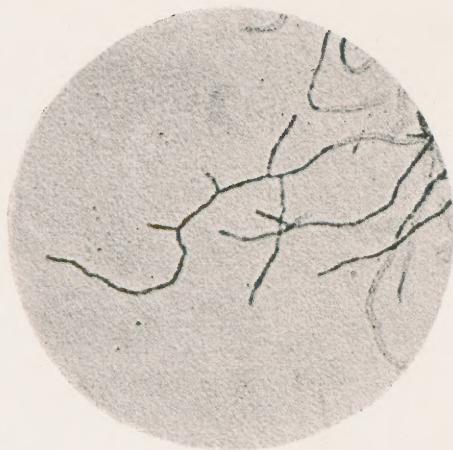


FIG. 1.

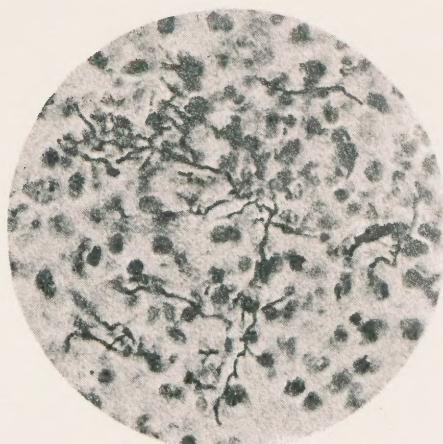


FIG. 2.



